Partial Oxidation for Improved Cold-Start in Alcohol Fueled Engines

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Subcontract Number

YCC-5-14050-01

Performance Period

6/95–5/97

NREL Subcontract Administrator

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Objective

To develop a compact partial oxidation reactor as a fuel system component that will dramatically improve the cold-start ability and reduce cold-start emissions for neat alcohol fueled engines.

Approach

We will undertake an experimental program to develop a prototype partial oxidation (POX) reactor for a light duty-ethanol fueled engine. During Phase I, we will conduct laboratory experiments to verify the feasibility of using ethanol partial oxidation for cold starts. Scoping experiments will use bottled gases blended to simulate POX products to assess cold start performance and

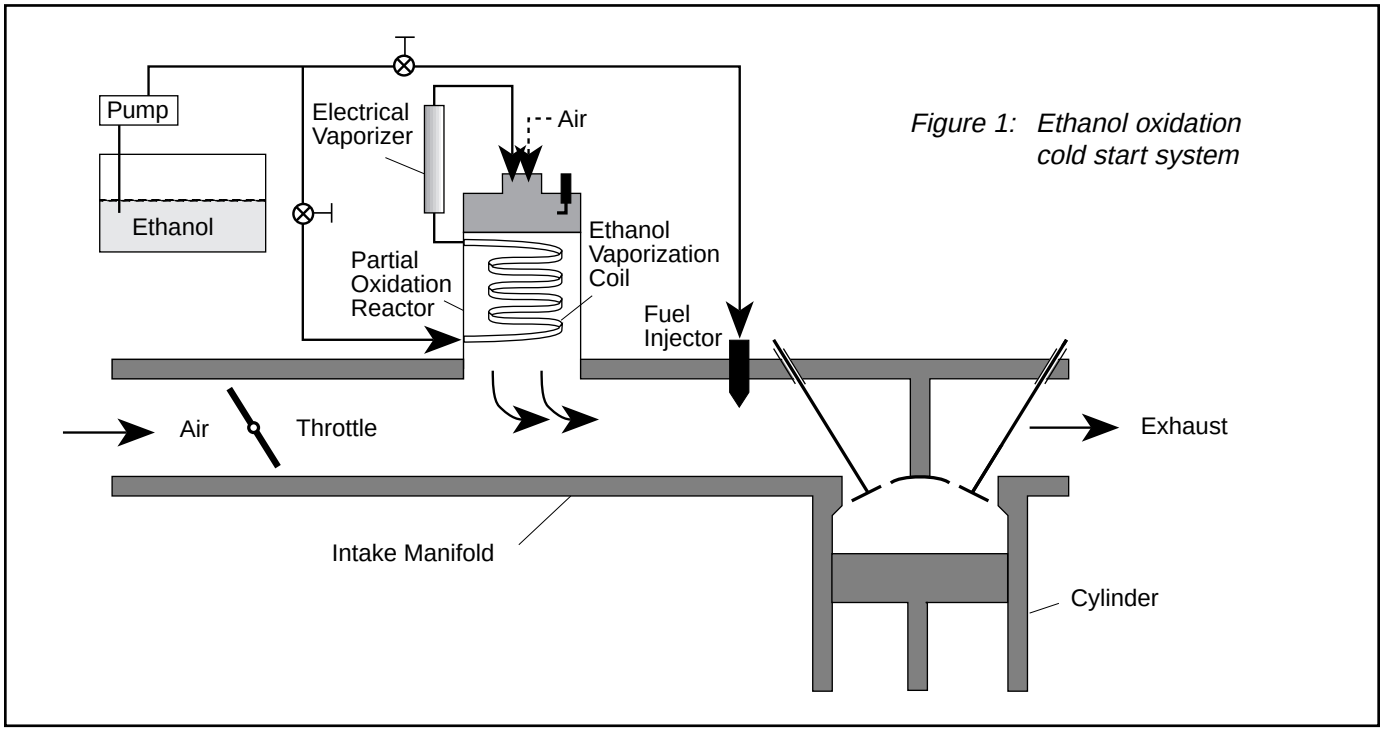

Figure 1: Ethanol oxidation cold start system

determine the required reactor operating envelope. Integrated engine/POX tests using an existing bench-scale reactor will be used to demonstrate actual POX results. The scoping and bench-scale results will be used to developed a conceptual design for a compact, partial oxidation cold-start system. In Phase II, we will fabricate and test the prototype system under a variety of realistic engine cold-start conditions.

Accomplishments

The experimental setup for the scoping experiments and bench-scale tests has been designed and is being assembled. A 3.1-liter test engine based on the Chevrolet Lumina flexible fuel vehicle has been received from General Motors and is being installed in an environmental chamber to simulate cold starts at low ambient temperatures (as low as -20° to -40°C). A gas-blending apparatus is being installed for the scoping experiments, and the bench-scale POX reactor is ready to be coupled to the engine.

Future Direction

Work will continue on scoping experiments and bench-scale tests to demonstrate the feasibility of dramatically improving cold-start ability for neat alcohol fueled engines. The empirical data developed during this phase will result in a conceptual design for the practical cold-start system in early 1996. The feasibility results and conceptual design will be reviewed and a go/no go decision will be made for continuing development of the prototype system. The prototype may then be tested in 1997 on an ultra-low emission ethanol vehicle currently under development by NREL.

Publications

None to date.

Figure 2: Cold start system development strategy